Nomination of the Tri-State Bear River Basin for the U.S. EPA Watershed Initiative Program

Contact Information:

Jack Barnett
Bear River Commission
106 West 500 South
Bountiful, UT 84010
1-801-292-4662
jbarnett@barnettwater.com

Including the Upper Bear (**16010101**), Central Bear (**16010102**), Bear Lake (**16010201**), Middle Bear (**16010202**), Little Bear-Logan (**16010203**), and Lower Bear-Malad (**16010204**) Hydrologic Units

This proposal does not address hypoxia in the Gulf of Mexico

Abstract

This proposal for EPA Watershed Initiative designation will implement studies in the tri-state Bear River basin to develop and demonstrate: 1) an integrated Watershed Information System to facilitate data collection, data analysis, information transfer, and public outreach; 2) a water quality trading program to allow point and nonpoint pollutant sources to trade water quality credits; and 3) dynamic water quality modeling to support water quality trading and analysis of potential water quality management scenarios. Our hypothesis is that water quality will be improved through an integrative holistic perspective on the watershed facilitated by the integrated Watershed Information System, and that trading will promote the most economically beneficial solutions to water quality problems within the geographic constraints and physical connectivity of the river basin and stream network.

1.0 Introduction

The 7,500 mi^2 Bear River Watershed (see Map A1) exemplifies many of the complexities faced in water quality management and is an excellent candidate for study and demonstration of how trading based on integrated watershed information and management can improve water quality. Currently, 52 streams and 9 lakes in the basin are listed on 303(d) lists of impaired waters in three states, Idaho, Utah, and Wyoming (see Map A2). Water quality problems include sediment, nutrients, fecal coliform bacteria, low dissolved oxygen, and high water temperature. Pollutant sources include animal feeding operations, grazing, agriculture, wastewater treatment, degraded stream banks, urban development, roads, phosphate mining, oil and gas exploration, and logging (BLRC and ERI, 1991; ERI, 1995; ERI, 1998). Eleven TMDLs have been completed, with an additional 42 presently in development. See Appendix B for a complete list of water quality studies in the Bear River watershed. Funds from EPA 319, USDA EQIP and other programs, as well as considerable landowner match, have been used to implement past and ongoing water quality projects throughout the watershed.

Water quality management in the Bear River Basin is complicated by the transboundary nature of the river, which meanders through three states and two EPA Regions with multiple jurisdictions and planning authorities. This has resulted in fragmentation in water quality improvement efforts. The ad hoc Bear River Water Quality Task Force (BRWQTF) was formed in 1993 to facilitate management of this multi-state watershed. The Bear River Commission, formed by compact in 1958 to allocate water use throughout the basin, created a water quality committee (WQC) which provides a more formal arrangement between the water quality heads of the three states. The BRWQTF now serves as unofficial staff to this committee. See Appendix C for details of this arrangement, which has enhanced interstate communication and

cooperation concerning water quality issues throughout the basin. The BRWQTF and WQC have identified the following needs for more fully integrated watershed management: innovative and cost-effective water quality solutions, a common source of merged datasets and planning tools, and a means to identify impacts and predict responses of program implementation on a basin-wide basis.

This proposal for EPA Watershed Initiative designation will implement studies to develop and demonstrate: 1) an integrated watershed information system to facilitate data collection, data analysis, information transfer, and public outreach; 2) a water quality trading program to allow point and nonpoint pollutant sources to trade water quality credits; and 3) dynamic water quality modeling to support water quality trading and analysis of potential water quality management scenarios. Our hypothesis is that water quality will be improved through an integrative, holistic perspective on the watershed facilitated by the integrated watershed information system, and that trading will promote the most economically beneficial solutions to water quality problems within the geographic constraints and physical connectivity of the river basin and stream network.

The set of problems and needs in the Bear River Basin are common to most if not all rural watersheds in the United States. Add to this the challenges associated with multiple jurisdictions and the benefit of having an organized interstate task force and commission, and the Bear River Basin is a microcosm for many western water issues and presents an excellent opportunity for studying innovative water quality improvement approaches.

2.0 Watershed Plan

The goal of the Bear River Watershed Plan is to restore water quality and protect beneficial uses through efforts that dissolve state and other arbitrary political boundaries, taking

a holistic watershed view and integrating, processing, analyzing, and sharing data throughout the basin. The plan includes a comprehensive, watershed-wide database and information system (WIS), a virtual trading room and associated water quality trading program for pollutant trading, and dynamic modeling of water quality to support planning and management. Following are detailed descriptions of the WIS, the water quality trading program, and the supportive dynamic water quality modeling projects that comprise this watershed plan.

2.1 Bear River Watershed Information System - The WIS will provide individuals and agencies in the basin a large array of fully integrated capabilities, including unprecedented access to data and data manipulation, modeling and visualization, and education and outreach. A fully functioning WIS of this scale is a critical missing component for effective watershed management in the Bear River watershed and in many watersheds nationwide. It is expected that the WIS will promote greater cooperation across state lines and among the different regulatory agencies and stakeholder groups in the basin. A prototype version of this system is currently under development using other seed funds and can be viewed at http://emrc.usu.edu/bearriver/. We intend to leverage this existing work and expand the system to include live and historical water quality and quantity, ecological, economic and cultural information, discussion rooms, modeling and data analyses, and significant education and outreach components. Notably, once the system is fully developed, Utah State University (USU) has committed to ongoing update and maintenance of the WIS through the campus-wide Water Initiative and associated funds.

Key elements of the Bear River WIS will include the following. **1) A watershed-wide coordination webpage** will contain contacts; information on current monitoring and implementation efforts; links to partners, data sources, calendars; training opportunities, upcoming events, and other selected information. **2) A comprehensive data warehouse** will

house and distribute historic temporal and spatial datasets including metadata. Datasets will include water quality, water quantity, and meteorological time series, and GIS data layers will include hydrologic, geographic, land use, and other data necessary for evaluating and managing water quality in the basin. The data warehouse will also include a georeferenced database and evaluation of past and current management activities in the basin. **3) A document warehouse** will link to an electronic collection of Bear River reports, documents, and cataloged photographs via the existing USU Natural Resources Library database. **4) Visualization and statistical tools** will be presented through a web-enabled map server. The WIS will include time series and summary data analysis functions for evaluating and viewing stream flow, water quality, and climate data at user-selected monitoring locations. **5) A virtual trading room** will provide online infrastructure and support for pollutant trading. This will include online tracking and account balancing. **6) Real time water quality data** will be collected and uploaded to the WIS. This will be supplemented by USU's Water Initiative. **7) Outreach and education** will include informational and training materials and links to watershed-wide and subwatershed water quality outreach efforts, on-line help in interpreting data and information about the watershed, and links to youth outreach programs in the watershed. Training sessions on the use of the WIS will be provided as well.

Expected outcomes and deliverables: The Bear River WIS will be developed and deployed at USU.

Schedule: Year 1: Assemble data and develop web-enabled data visualization components. Development of WQT infrastructure. Years 1-3: Integrate outreach components.

Budget: **Federal share: $209,890**, Total budget: $352,890

2.2 Water Quality Credit Trading Program - A pollutant trading program to reduce total phosphorus (TP) loads in the Bear River will be implemented in accordance with EPA's Water Quality Trading Policy (EPA, 2003). This trading program will be designed to improve water quality by providing economic incentives that will encourage voluntary participation in TMDL implementation for those who may not normally participate, and is expected to reduce the cost of TMDL implementation relative to conventional approaches. The effects of existing alternative market-oriented enterprises that eliminate TP loading (i.e., composting, energy production from animal waste, etc.) on water quality and incentives in the WQT program will also be examined.

Existing TMDL studies, involving both monitoring data and modeling efforts, will be the leading market driver for the WQT system and have identified many individual contributors, classes of contributors, and the TP loads associated with these. In addition, the TMDLs have already allocated loads and identified potential Best Management Practices (BMPs). These loading data provide a common metric for a market in TP, and will enable this project to move forward without the need significant new water quality studies.

The WQT project will be conducted within the Middle and Lower Bear River, including the Spring Creek/Little Bear River drainage. These reaches directly affect water quality and ecological conditions of the Great Salt Lake and have existing TMDLs for TP that have not been implemented to date. Using the loading capacity of these systems defined by the existing TMDLs as the initial starting point, numerous non-point sources and a limited set of point sources will be evaluated for trading. The results of this study will be used as a model to develop a more comprehensive water quality trading program basin-wide.

The regulatory mechanisms, trading infrastructure, rules, information communication, and trade transaction/cost structure will be developed according to accepted theory and protocols

(cf. Kling and Rubin, 1997; Lence, 1991; EPA Region 10, 2003). These components will be implemented within the WIS described above to provide the public and potential traders the necessary information and tools for evaluating the costs and benefits of potential trades and will be the medium for implementing and evaluating the effectiveness of trades. The WIS will manage eight primary functions of the market including: a) definition of marketable reductions of TP; b) buyer-seller communication; c) establishment of environmental equivalence, if assurance is needed; d) execution of the trading process; e) tracking of trades to minimize friction and to obtain information about the effectiveness of the demonstration; f) assuring compliance; g) management of risk among trading parties, and h) information communication to the public and stakeholders.

Monitoring procedures will be developed and implemented in order to support the trades that will take place, check the use, type, and effectiveness of potential BMPs, and to derive information on the extent to which water quality is enhanced and implementation costs are minimized by the trading process. In-stream monitoring for TP concentrations at critical locations will be conducted by Utah DWQ's monitoring section.

Expected outcomes and deliverables: The success of trading in terms of kg of TP removed in this pilot project, water quality improvement, costs involved, timing of implementation, and public satisfaction will be tracked and compared to results from more conventional approaches. The results will be published, summarizing the effectiveness, benefits, and disadvantages of market trading in this watershed, and identifying those factors necessary for success and barriers to successful implementation.

Schedule: Year 1: Assemble information, setup trading infrastructure and integrate with the WIS, and identify trades. Year 2: Initiate trading and monitoring. Year 3: Evaluate and

monitor trading process.

Budget: **Federal share: $149,446**, Total budget: $161,246

2.3 Dynamic Water Quality Modeling - A dynamic water quality model will be used to help track and evaluate TP loads and the effects of trades in the water quality trading program. An existing prototype dynamic model for stream flow in the Bear River will be upgraded and modified to predict temporal changes in TP loads under different meteorological inputs, flow regimes, and management options in those areas where the WQT program will take place. The model will allow decision makers to compare the outcomes of different management options and to evaluate water pollutant trading data and criteria in a spatially explicit and dynamic manner.

The model will target site specific applications, and will be calibrated and corroborated with site specific historical monitoring data. Modeling will evaluate individual trading viability by incorporating TP discharges from reach-specific point and nonpoint sources and by examining changes in water quality over time and distance. The effects of timing, river distance between potential seller's and buyer's locations, river conditions, and operational activities such as withdrawals and diversions will be assessed. Modeling will also predict actual TP reduction via BMPs and will provide a means of comparing potential BMP effectiveness. Monitoring data associated with the WQT sites will be used as model inputs and to test predicted results.

Modeling will also be used in developing equivalence ratios or similar mechanisms to account for inputs, withdrawals, and diversions and the distance between potential sellers' and potential buyers' locations. This will help determine if trade transactions need to be based on equivalence relationships, to provide information to the market, and to account for localized impacts. Sufficient information is available for both TP sources and loads where TMDLs have been completed to develop watershed discharge profiles and to identify TP loading and timing.

Expected outcomes and deliverables: A calibrated and validated dynamic water quality model will be developed and executed to evaluate the potential for water quality trades, both in cost effectiveness and TP load reduction. An executable version of the model will be available in the WIS. Outputs of the model used for specific trades will also be summarized in the WIS.

Schedule: Year 1: Upgrade the model to include historic and current flow and water quality data. Year 2: Execute and refine models to support the evaluation of environmental equivalence of potential trades. Year 3: Execute and document models in support of WQT program.

Budget: **Federal share: $256,028**, Total budget: $256,028

3.0 Project Management

This project represents collaborative efforts of many entities, each represented on the BRWQTF. The Bear River Commission will be the fiduciary agent and manage the grant. Primary oversight for the project will rest with the Bear River Water Quality Committee, composed of the water quality agency administrative heads from Utah, Idaho and Wyoming (see Appendix C). The Water Quality Committee will also be essential in communicating between the Bear River Commission, the individual project leaders, and the BRWQTF. The bulk of the database, GIS and modeling work will be conducted at USU and the Idaho National Engineering and Environmental Laboratory. The following will be the primary project leaders:

Jack A. Barnett (Bear River Commission) has a Masters Degree in ground-water geology and extensive experience in interstate water right and water quality issues and organizations, having served as the Executive Director of the Western States Water Council, the Colorado River Basin Salinity Control Forum and now as Engineer-Manager for the Bear River Commission. Earlier in his career he was involved in water right administration in Utah and Idaho and has professional licenses in both engineering and geology.

Dr. David K. Stevens, P.E. (USU) is a Professor of Civil and Environmental Engineering at the Utah Water Research Laboratory and USU. He has been P.I. or Co-P.I. on fourteen projects over the past 10 years, with total funding in excess of $6 million, related to integrated watershed modeling, data analysis, assessment, and decision-making for U.S. EPA, U.S.B.R., D.O.E., private industry, and States of Utah and Washington agencies. Dr. Stevens brings to the team experience in modeling the quality of surface waters and contaminants in the vadose zone, and the integration of surface water quality and quantity models to assess the impact of watershed management on surface water quality.

Nancy Mesner (USU) has Masters Degrees in Limnology and Environmental Engineering from the University of Washington. As a private consultant, she has directed several large projects, including the Lower Bear River Management Plan (the first TMDL study in Utah) and 3 other projects in the Bear River watershed. She is an Assistant Professor at USU (Aquatic, Watershed and Earth Resources Dept), a Water Quality Specialist and state Water Quality Coordinator for USU Extension, is co-chair of the Cub River TAC, and is actively involved in the BRWQTF.

The project will also benefit greatly from other partners, including PacifiCorp and nonprofits such as Bear Lake Watch and Friends of GSL. It will also benefit from the level of effort already ongoing in the Bear River watershed, including the USU Water Initiative, which has identified the Bear River as its laboratory watershed and brings match in the form of equipment, faculty, staff, and student time and outputs.

Budget: Federal share: $72,681, Total budget: $82,681

4.0 Outreach Programs

4.1 Information and Outreach Plan - This project will coordinate closely with the Task Force, the Bear River Water Quality Committee, and other stakeholders. Through meetings,

conference calls, and email communications we will ensure that we are inclusive in our information gathering for the WIS and water quality model. The success of the water quality trading project in this proposal depends of early and active involvement with those agencies, municipalities and private parties involved in actual implementation of pollution control efforts.

The Internet-based WIS will serve as one platform for significant information and outreach efforts. In addition to the WIS, a series of neighborhood meetings will be organized to increase public awareness and for information exchange on all aspects of the project. We will also conduct trainings on the WIS in each state and with the BRWQTF, and will promote it throughout the watershed and region through the media, fliers, web links and more.

The project will also coordinate with and support existing education and outreach programs in the basin. These include a watershed-based school program for grades 7-12; a watershed festival in the Bear River basin, first held in 2002, training opportunities for groups on BMPs, watershed management principles; and more. Other federal funds (EPA 319 and USDA CSREES Water Quality Program funds will be leveraged in this effort. .

4.2 Knowledge Transfer to Other Watersheds - By establishing an Internet-based WIS and project website, knowledge gained from these and other projects within the basin should be readily transferred to other watersheds within the region and across the country. Interesting results of this project will be published in appropriate journals and presented at conferences, including the National Watershed Initiative Conference, and training on developing a WIS will be provided to interested individuals and organizations.

Budget: Federal share: $111,478, Total budget: $226,378

5.0 Budget

Table 1. BUDGET INFORMATION - EPA Watershed Initiative Grant Program[1]

SECTION A - BUDGET SUMMARY						
Watershed Project, Activity or Work Plan Element			Federal	Non-Federal		Total
1. Watershed Information System			$209,890	$143,000		$352,890
2. Water Quality Trading Program			$149,446	$11,800		$161,246
3. Water Quality Modeling			$256,028	$0		$256,028
4. Outreach			$111,478	$114,900		$226,378
5. Project Management			$72,684	$10,000		$82,684
Totals			$799,527	$279,700		$1,079,227
SECTION B - BUDGET CATEGORIES						
	Watershed Project, Activity or Work Plan Element					Total
Budget Categories	(1)	(2)	(3)	(4)	(5)	
a. Personnel	$100,934	$79,316	$118,891	$54,437	$46,518	$400,096
b. Fringe Benefits	$31,066	$21,199	$0[a]	$14,763	$11,629	$78,658
c. Travel	$10,000	$3,500	$10,000	$6,000	$6,542	$36,042
d. Equipment	$4,000	$0	$0	$0	$3,634	$7,634
e. Supplies	$5,000	$3,500	$0	$5,000	$4,361	$17,861
f. Contractual	$0	$0	$0	$0	$0	$0
g. Construction	$0	$0	$0	$0	$0	$0
h. Other	$0	$0	$0	$0	$0	$0
i. Total Direct Charges (sum line a-h)	$151,000	$107,515	$128,891	$80,200	$72,684	$540,291
j. Indirect Charges	$58,890	$41,931	$127,137	$31,278	$0	$259,236
TOTALS (sum line i-j)	$209,890	$149,446	$256,028	$111,478	$72,684	$799,527

[a]Benefits for INEEL personnel are included in category a. Personnel.

[1] Excerpted from Standard Form 424A, OMB Circular A-102

References

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